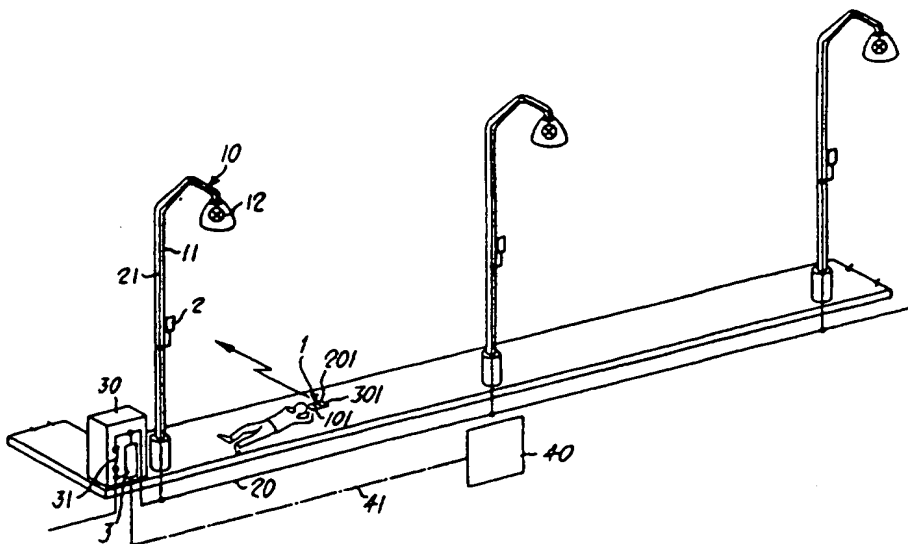


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(54) Title: GLOBAL TELECOMMUNICATION, MONITORING AND TELESIGNALLING NETWORK



(57) Abstract

Telecommunication, monitoring and telesignalling network, comprising: a plurality of mobile signals receiving and transmitting terminals; a plurality of pick up elements, each one being able to be connected to said mobile terminals, each pick up element being placed in correspondence of a light point of the public lighting installation, and connected to said installation and provided with means for the transmission and the reception of signals through the lines of said public lighting installation; and a plurality of control units connected to said lighting installation, which are able to be connected to said pick up elements, each one of said control units being placed in a distribution substation of said lighting installation, and being connected with the bunch of pick up elements disposed on the light points connected to said substation, each control unit being provided with means for the transmission and reception of data to and from an operative station.

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TITLE OF THE INVENTION

Global telecommunication, monitoring and telesignalling network

BACKGROUND OF THE INVENTION

The present invention relates to a telecommunication network, and in particular it relates to a telecommunication, monitoring and telesignalling network.

For quite a time it has been asserted the need of developing systems which guarantee to citizens a timely assistance in answer to the most common emergency requirements, e.g. sanitary, public order emergencies or connected to accidental events as fires or floodings. Furthermore it is always more pressing the demand for a more efficient management of the public transport, of the private traffic, and in general for a better accessibility to the basic services from both citizens and visitors of our towns.

By modern technologies is has become finally accessible what in past was merely theoretical, that is to think to be able to provide the important urban centres, and gradually the entire territory, with a telecommunications network that can perform a lot of the above exposed needs. However remained a great problem in the real difficulty of inserting, in the complex structure of the towns, a network with such a capacity and such a capillarity to satisfy entirely said needs, without going towards enormous costs and as much enormous adaptation works.

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In the Italian patent application N.T096A000183 is described a signaling system that overcomes the difficulty of providing a communication network by utilizing, in a manner so to say "parasite", the preexisting urban lighting network and the respective electric lines. The data transmission takes place in a practically unidirectional manner, if it is excepted the possibility of the confirmation that the transmission from the portable transmitter took place. The data transmission on the electrical network by means of peripheral units, located on each light point of the lighting network, to the reception exchanges, located in the substations for distributing the electrical energy to the single street lamps, takes place by using conveyed waves transmission methods, such as, for example, modulated frequencies on carrier frequency.

A system so conceived presents however some drawbacks. Firstly, there is not a concrete possibility of a communication between the network and the user possessing the remote device, so that the user, apart a simple signal of received message, do not know how and in how many time his demand will be performed; further it is not provided the possibility of furnishing information to the user through the network, beyond the emergency situations. Secondly, the use of a data transmission on the network by conveyed waves presents considerable practical difficulties for its application.

In fact, the emitted signal must have a certain power in order to obtain an appreciable result, there is the risk of

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noises, as beats with systems of the kind of AM transmission or wire broadcasting, thus with the need of verification, for each cable used, of the pass band and of the possible interference with other signals. Furthermore, the transmission and the data reception speed between the peripheral terminals and the reception exchanges is rather restricted.

In the Italian patent application RM96A000116 a data transmission system is described also making use of the street lighting network; said system however do not foresee the use of mobile terminals, and is articulated into three levels, that is supervision level, control level, and field stations level. The data transmission between the peripheral units and the control level takes place by the emission of not modulated tones, which permits a data stream of greater dimensions with respect to the previously described system. However such communication is based on the assumption that each peripheral unit of the network be in turn into communication with the exchange, thus denying the possibility of a reaction to a plurality of simultaneous calls. Further each peripheral unit sends with its message, its identification code, with the consequent consumption of available characters.

SUMMARY OF THE INVENTION

Scope of the present invention is to provide a communication network which is able to overcome the above described drawbacks, by allowing a bidirectional communication between mobile terminal and network, and at

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the same time providing said network with a data transmission system which is less influenced by possible interferences, and which allows a greater data stream along the network by the use of reduced power.

Object of the present invention is therefore a telecommunication, monitoring and telesignalling network, characterised by the fact that said network comprises:

- a plurality of mobile receiving-transmitting terminals;
- a plurality of pick up elements, each one being able to be connected to the said mobile terminals, each pick up element being disposed in correspondence of a light point of the public lighting installation connected to said installation, and provided with means for the transmission and the reception through the lines of said public lighting installation; and
- a plurality of control units connected to said lighting installation, which are capable to be connected to said pick up elements, each control unit being disposed in a distribution substation of said lighting installation, and being connected to the plurality of pick up elements located on the light points connected to said substation, each control unit being provided with means for the reception and the transmission of data to and from an operative exchange.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and features will be evident from the following detailed description of one embodiment of the present invention made, by way of non limiting example, with reference to the annexed drawings, in which:

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Figure 1 is a schematic perspective view of a telecommunication network according to the present invention;

Figure 2 is a schematic diagram showing a network pick up element according to the invention;

Figure 3 is a schematic diagram showing a network control unit according to the invention; and

Figure 4 is a diagram representing an oscillation cycle of the tension of the public lighting network.

DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

In Figure 1 a telecommunication network according the present invention is shown; with 1 the mobile receiving and transmitting terminal is designed. Said terminal 1 comprises a processing unit 101, a transmitting group 201 and a receiving group 201. Said terminal is able to communicate with the pick up element 2 disposed on the pole 11 of the street lamp 10 and connected to the cable 21 which feeds the lamp 12 of the street lamp 10, and which in turn is connected to the urban lighting installation line 20. As known, in an urban lighting installation a shunt substation is provided for any given light point number, controlling their power supply. In the Figure, in the shunt substation 30 the control unit 3 is inserted in parallel with the switch 31 of the said substation, same being connected through the connecting means 41, which in the following will be better described and illustrated, to the operative

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station 40.

In Figure 2 a diagram is shown schematically showing a pick up element 2 of the net according to the invention. Same comprises a processing unit 102 provided with a feeder 112 connected through the wire 122 to the cable 21 of the street lamp 10. To the processor 102 a radio interface 202 is connected, to which the transmitting group 212 and the receiving group 222 respectively provided with antennas 232 and 242 are connected. Likewise to the processor 102 the transmitter 312 and the receiver 322 are connected, which in turn are connected through the respective wires 332, 342 to the wire 122 coupled to the cable 21 of the street lamp 10.

In Figure 3 a diagram is shown showing a network control unit 3 of the network according to the invention. Said unit comprises a processor 103 connected to the street lighting installation line 20 through a feeder 113. To the processor 103 the transmitting group 213 and the receiving group 223 are connected; both said groups are finally connected to the line 20. To the processor is further connected the tension shutter 303, the mode of operation of which will be described later. As last, the processor is provided with a connection with an interface 403 communicating with the connecting means 41 for the connection with operative station 40.

In Figure 4 is finally shown diagrammatically the sinusoid which represents the tension oscillation of the public lighting network. In abscissa the diagram has time

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values in seconds and in ordinate tension values. As it may be seen the diagram is subdivided into 10 subperiods, of which two subperiods 23 are wider in correspondence with the maximum and minimum values of the single oscillation, and 8 subperiods which are equal each other.

The operation of the communication network according to the invention will be evident from the following. The mobile terminal 1 shown in Figure 1 permits to the user 50 to send a signal 401 through his transmitting unit 201, containing the aid request and other possible data processed or memorized in processor 101 of the terminal 1. The signal may be received by the pick up element 2 placed on pole 11 of the street lamp 10. Once received the signal 401, the pick up element 2 will send it to the control unit 3.

In the prior art devices of the kind described, the tranfert of the data from the peripheral unit, similar to the pick up element of the invention, to the communication network takes place by the use of conveyed wave transmission systems, which presents the already mentioned drawbacks. In the network according to the invention said transfert is performed by a system which faces the problem in a quite new and innovative way. The starting assumption is based on the fact that every single pick up element is connected to the network and synchronized on the network frequency, that is 50 Hz. Thus the wave presents 50 cycles during the space of one second, that is 20 milliseconds (msec) per cycle. The signal modulation means 302 of the pick up elements divide furthermore each cycle (see Figure 4) into ten subcycles, of

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which the two wider cycles 23 in correspondence of the maximum and minimum points of the oscillation are not taken into consideration. In this manner eight subcycles 24 of 1,5 msec each remain. The single pick up element sends in each subcycle a tone, emitted in a range comprised for example within 2 and 4 kHz and characteristic of a single pick up element, where the tone presence shows that a signal bit has been dispatched at a logical level 1, and thus that in a 20 msec space, that is a complete oscillation cycle of the network feeding tension, a signal containing eight data bit, that is a character (byte) may be dispatched. Then in one second only the pick up element may transmit 50 bytes of data.

The different pick up elements have each a characteristic emission tone, and the emission frequency difference between adjacent pick up elements is typically in the range of 20 Hz, which is an extremely small value, however sufficient because the tone bandwidth is practically of null value. Thanks to this last characteristic it is very difficult that this kind of data transmission be subject to interferences.

In order that the control unit be able to distinguish the different messages sent by different pick up elements connected to it (for example 100 pick up elements for a same control unit) it must have a Digital Signal Processing device (DSP). Assuming as frequency distance between pick up element and pick up element a frequency of 20 Hz as above referred, the DSP has to distinguish between the different

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signals on a total band of 2 kHz. Advantageously, the recognizing of each pick up element by the control unit can take place in this manner through their emission tones, with a significative character saving, because no identification data have to be sent. A further advantage of the data transmission by tones at the frequencies in the ranges above mentioned, resides in the use of an extremely limited power on all the network.

The datum aquired from the control unit, and containing the information of the position of the calling terminal, as well as those relating to the kind of requested service, is thereafter conveyed, through suitable connecting means, as for example a transmission made with the aid of a satellite or a connection via optical waveguides, to the operative station, where the datum will be collected and decoded and from where the answer to the user's requirement will be forwarded.

A further problem for a communication network using the lines of a street lighting installation is that during the day the street lamps are off, and is not desirable to keep them on both because of the great electric energy waste which will come from, and because of the impossibility of doing the normal maintenance. The control unit 3 comprises a tension shutter device 303 which has the duty, whenever the switch 31 of the cabin 30 is opened, to deliver a low voltage, in the range of 40-50 V, in alternating current at 50 Hz, on the length of line 20 connected to the different street lamps, so as to guarantee both the feeding and the

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transmission of the pick up elements placed on street lamps. As soon as the switch 31 is again closed, the shutter 303 will be automatically cut out.

The thus conceived telecommunication network permits to the user to receive informations and to transmitt informations by the same network; at the same time, thanks to the transmission system used in the communication between pick up elements and control unit, the data flow is greater then that which may be achievable by known systems, in correspondence with a greater practicality of use and minor signal noise possibilities.

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CLAIMS

1. Telecommunication, monitoring and telesignalling network, characterised by the fact that said network comprises:

-a plurality of mobile signals receiving and transmitting terminals;

-a plurality of pick up elements, each one being able to be connected to said mobile terminals, each pick up element being placed in correspondence of a light point of the public lighting installation, and connected to said installation and provided with means for the transmission and the reception of signals through the lines of said public lighting installation; and

-a plurality of control units connected to said lighting installation, which are able to be connected to said pick up elements, each one of said control units being placed in a distribution substation of said lighting installation, and being connected with the bunch of pick up elements disposed on the light points connected to said substation, each control unit being provided with means for the transmission and reception of data to and from an operative station.

2. Network according to Claim 1 characterized by the fact that each of said pick up elements comprises: a processor provided with feeding means connected to the feeding line of said lighting installation; means for the reception and the transmission of signals to and from said mobile terminal; means for the transmission and the reception of signals to and from said control unit, all connected to said feeding line of the installation and to

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said processor through means for the modulation and demodulation of said signal.

3. Network according to claim 2, characterized in that said signal modulation means comprise: means for the subdivision of each obscillation cycle of the current of the feeding line of the public lighting installation into ten subcycles, two of which, corresponding to the maximum and minimum values of said obscillation, are not taken into consideration, whilst the eight remaining subcycles correspond to eight bit of a character of the datum to be transmitted; means for emitting a tone with a frequency comprised between 500 and 5000 Hz for each bit having a logical level equal to 1, the difference in frequency between the tones of two contiguous pick up elements being comprises between 20 and 50 Hz.

4. Network according to claim 2 or 3, characterized by the fact that each of said control units comprises: a processor connected through a feeder to said feeding line of said public lighting installation; a transmitter and a receiver connected to said feeding line and connected to said processor through a digital signal processing device.

5. Network according to claim 4, wherein said digital signal processing device comprises means to distinguish, in a frequency band from 1 to 2 kHz, the tones emitted by each of the pick up elements connected to said control unit.

6. Network according to anyone of the preceeding claims

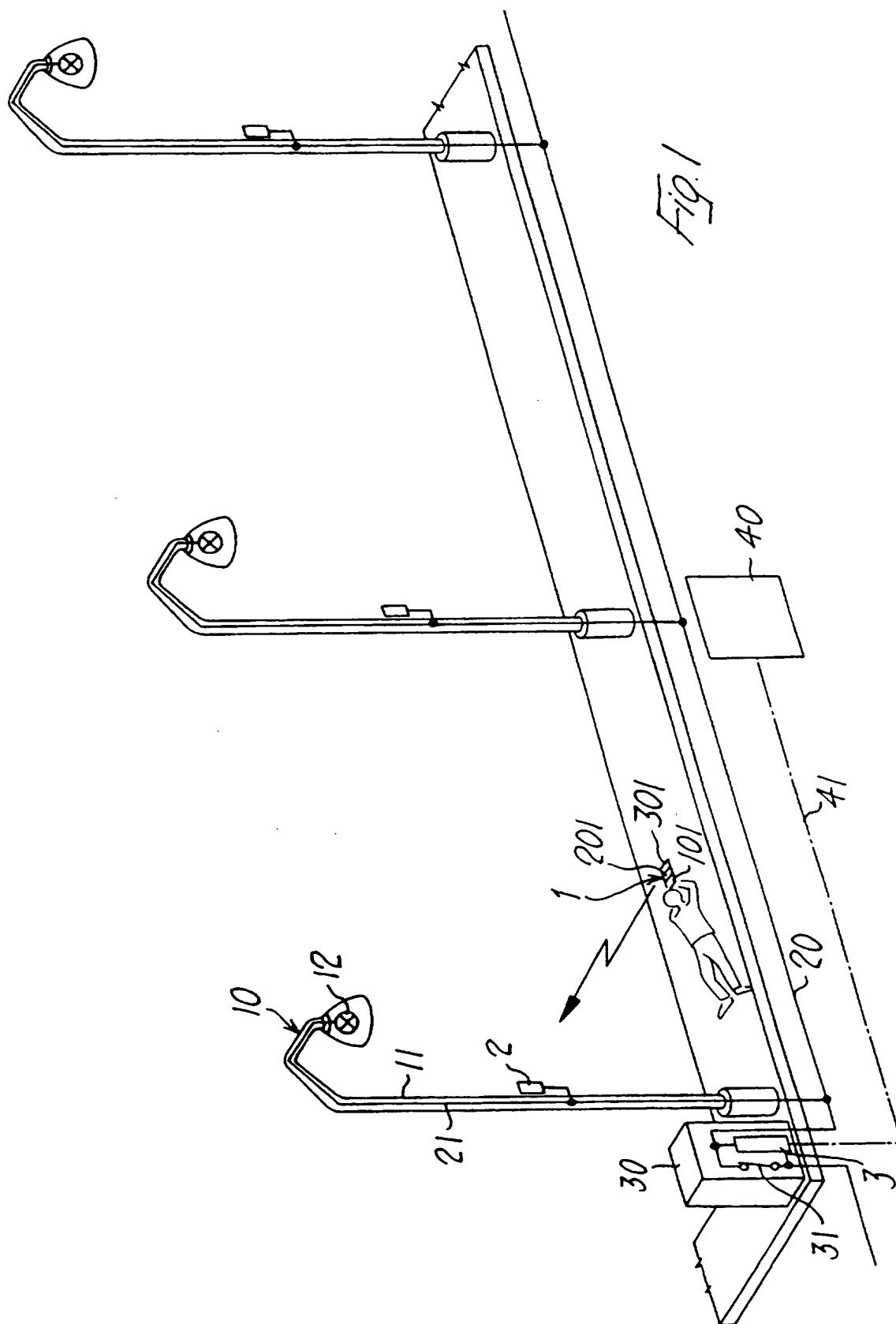
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from 1 to 5, characterized by the fact that each one of the said control units is connected, in the derivation substation of said lighting installation, in parallel with the switch means which control the ignition of the light points connected to said substation and is provided with a tension shutter device which, any time the switch means are opened, consents the delivery of a low tension, in the range of 40 to 50 V to the light points, at the same frequency as the network tension, said shutter being automatically cut out from the circuit whenever the said switch means are shut off.

7. Network according to anyone of the preceding claim from 3 to 6, wherein said tones are delivered preferably at a frequency range comprised between 2000 and 4000 Hz.

8. Network according to anyone of the preceding claims from 3 to 7, wherein the tone frequency difference between the tones of two contiguous pick up elements is preferably of 20 Hz.

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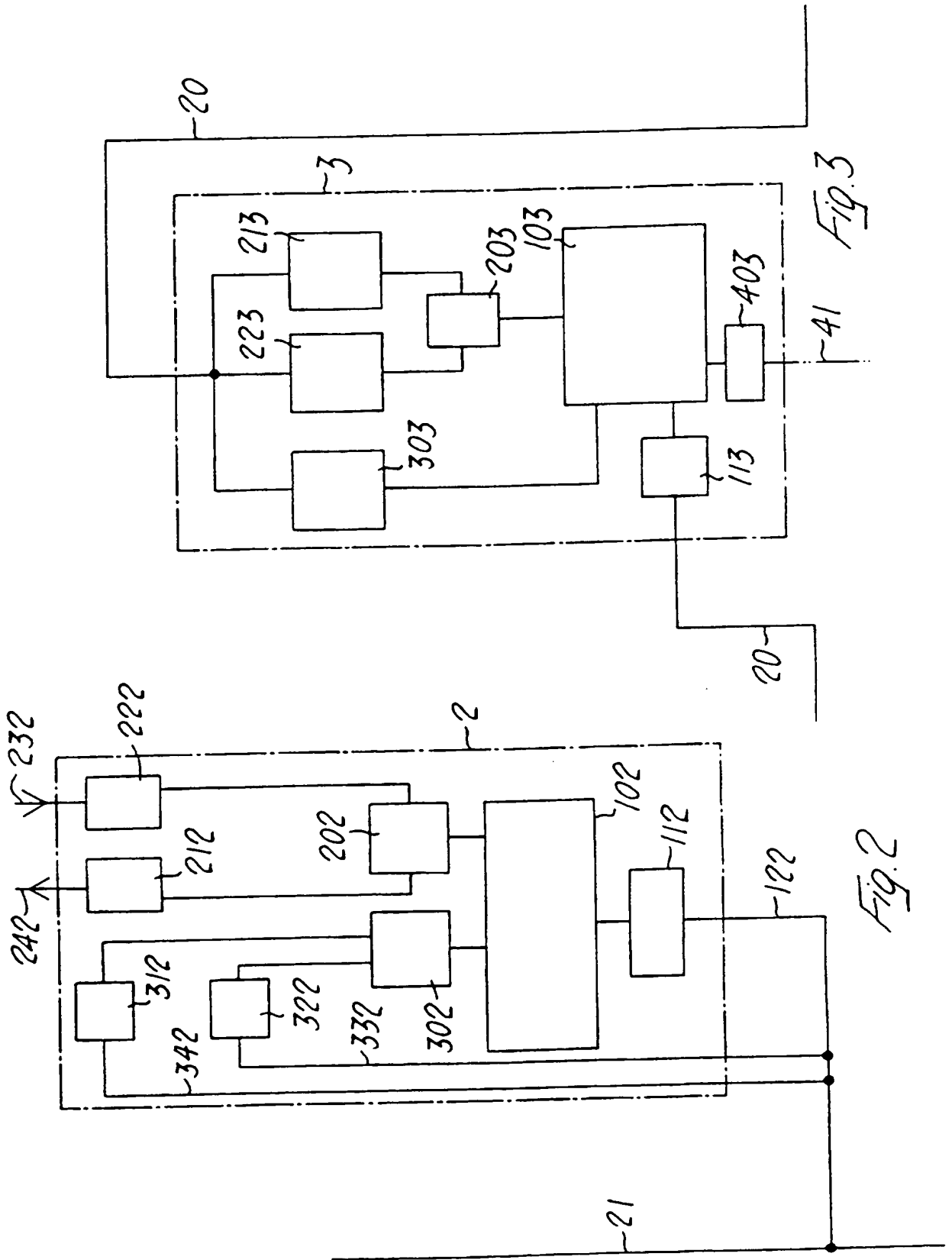
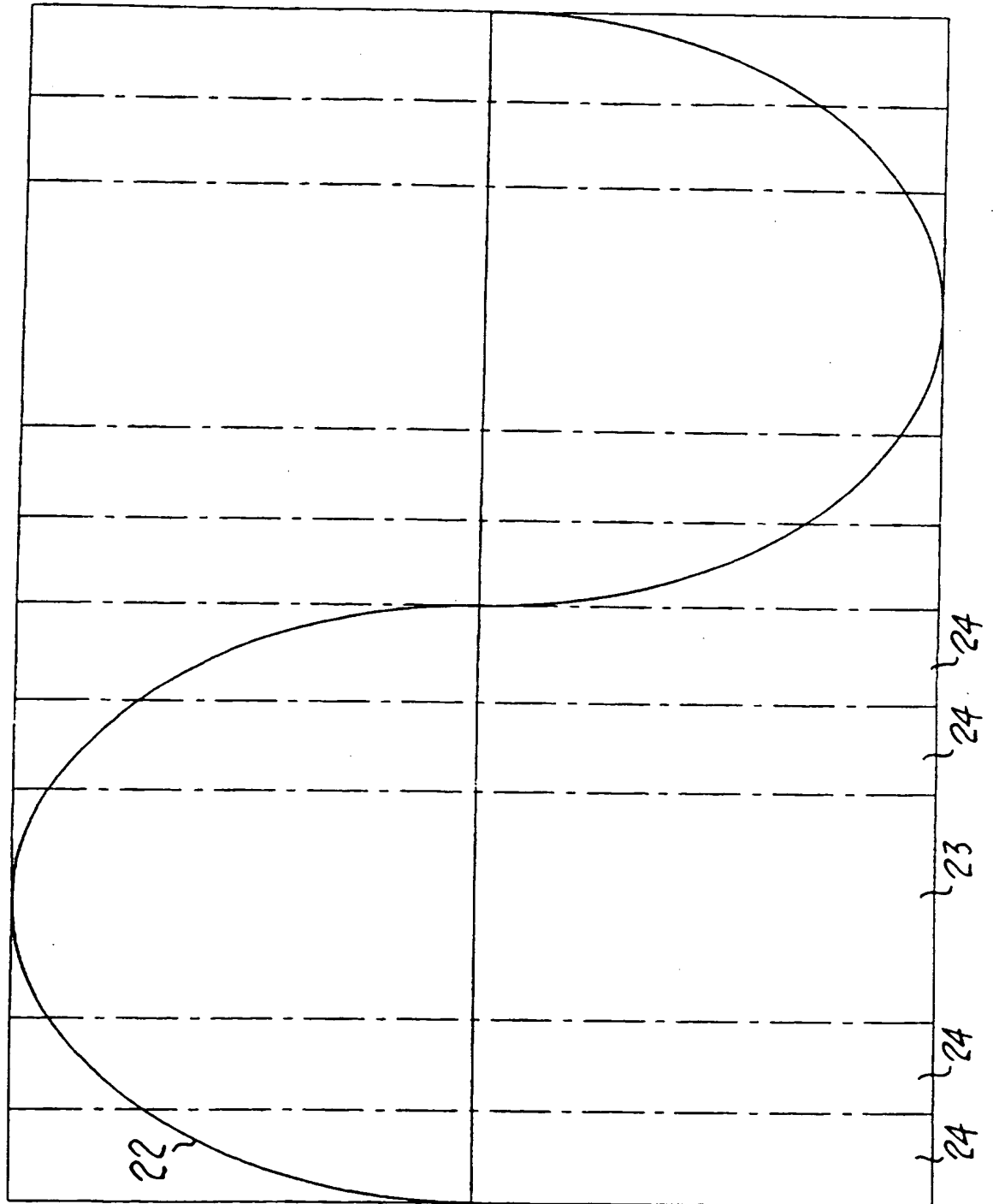


Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 97/04528

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04B3/54 G08B25/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G08B H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
Y	US 4 998 095 A (SHIELDS NEAL G) 5 March 1991 see column 3, line 4 - line 20 see column 3, line 34 - line 40 see column 4, line 55 - line 58 ---	1
Y	GB 2 291 993 A (PTF CONSULTANTS LTD) 7 February 1996 see page 1, line 1 - line 5 see page 13, line 1 - line 24 ---	1
A	FR 2 606 234 A (NIPPON DENKI HOME ELECTRONICS) 6 May 1988 see page 3, line 6 - line 9 see page 3, line 24 - page 4, line 7 see page 4, line 32 - line 35 see page 5, line 20 - page 6, line 23 -----	1

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Date of the actual completion of the international search

17 December 1997

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Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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